

## Contest 2: Engineering

This contest considers aspects of engineering that are not comprehensively evaluated in the objective contests, i.e., Contests 5 through 10.

### ***Engineering Design and Implementation (100 pts):***

A jury of engineers will evaluate the house's building envelope, indoor environmental control, mechanical, electrical, and plumbing systems according to the following criteria:

- Functionality
- Efficiency
- Innovation
- Robustness
- Short- and/or long-term economic value.

### **Energy Analysis (50 pts):**

A jury of building energy simulation experts will evaluate the team's Schematic Energy Analysis Report, Final Energy Analysis Report, and Simulation Input Form. The Energy Analysis Jury will assess the team's use of simulation tools to inform design decisions and predict annual energy performance. Teams are encouraged to apply the concepts of whole building design during the design phase, including the use of computer simulations to model alternatives. The Jury will evaluate the report according to the following criteria.

- Assumptions: Significant assumptions regarding the analysis or simulation (or both) are identified
- Simplifications: The simulation is as simple as possible without compromising accuracy, and all significant simplifications are identified and justified
- Improvisation: Currently available software may not contain routines for all situations, and any necessary improvisations to simulate a specific component or system are documented and justified
- Energy performance: Design steps taken to optimize energy performance, including predicted annual energy requirements of the proposed design, are discussed.

The Jury will be looking for effective communication and synthesis of the team's design and analysis process with focus on the application of sound modeling and engineering principles and creative analysis according to the following criteria.

Communication:

- Effectively communicates the intended integration of building elements and systems
- Communicates the analysis steps supporting design recommendations, including parametric and optimization studies and custom and specialized analysis for specific components
- Demonstrates effective, creative use of graphics to condense and summarize key analysis
- Conveys the design process (architectural programming, design goals, and whole building strategies)
- Includes summary drawings of the plan and elevation to convey key geometrical and architectural information
- Demonstrates organization and consistency in main and supporting documents
- Innovative visual style enhances organization and access to report findings.

Engineering:

- Summarizes clearly the thermal and electric loads used in the analysis, and includes comparison or reference (or both) to standard load assumptions, such as *ASHRAE Standard 90.2*
- Summarizes clearly the key assumptions such as envelope characteristics, lighting level, and thermal set-points
- Demonstrates awareness and testing of design against “high performance” energy efficiency strategies
- Demonstrates awareness and attempt to integrate building architecture and systems
- Demonstrates innovative and creative analyses where standard tools are limited
- Identifies clearly the key assumptions and supporting information where engineering approximations are required
- Demonstrates quality control checks (e.g., order-of-magnitude analysis, corroborating data from multiple sources, sign-off by multiple reviewers) on component and overall analysis.

| Contest Activity                      | Points Available |
|---------------------------------------|------------------|
| Engineering Design and Implementation | 100              |
| Energy Analysis                       | 50               |
| <b>TOTAL</b>                          | <b>150</b>       |